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INFECTION CONNECTION

TRACKING THE SPREAD OF HIV IN MALAWI

by Angela Conner

The Island of Likoma sits in the northern part of Lake Malawi in western sub-Saharan Africa. A rocky rectangle of sparse grassland and baobab trees, it has a population of roughly 7,000. It's not a place of passage. Once a week, an ancient-seeming steamer boat traverses the 40 miles from the nearest mainland port, a trip that generally takes more than 10 hours. The islanders gather to mark the steamer's arrival and to drink the cheaper beer on board.

Fishing is the main economic activity. The men spend hours on the lake, and women travel often to the mainland to sell the catch. There is a trading center in the middle of the island, and an anachronistic cathedral – comparable in size to Winchester – built by Anglican missionaries at the turn of the 19th century. There are soccer games and dances, and there is electricity until 10 o'clock at night. There is also a high rate of HIV infection, about 10 percent of the population.

Since the beginning of the world's HIV epidemics, most research has focused on "high-risk" behaviors – whether or not one uses a condom or engages in sex with someone who has a large number of partners. But in most of these studies, there has been no real correlation between risky behavior and the risk of becoming infected. Enter the Malawi Research Group at Penn.

In 2005, Stephane Helleringer, Gr'07, then a doctoral student, together with colleagues from the Wharton Healthcare Management Program and Penn's School of Nursing, took that lumbering steamer to Likoma. Ladened with computers, GPS equipment, survey forms and lab supplies, the group set out to map the social networks of the island and to identify sexual partnerships and how HIV spread along the paths that connected them.

Social network analysis is not new and not unfamiliar. Think six degrees of separation. But most studies of HIV transmission that have adopted this perspective have been artificial, based only on computer simulations and projections, or they have included only a small portion of a population

and focused on an individual's behavior. In surveying the entire population, asking not only who did what but with whom they did it and where those people are located, Stephane's team hoped to discover the specific means by which HIV had become so diffuse within the Likoma community.

It was a major undertaking that required a major public relations campaign. Though Likoma has been favored with government initiatives and general education is pervasive on the island, knowledge of the disease is not wide-spread. Witchcraft still has a strong hold, and most premature deaths are interpreted as the work of occult forces. The team recruited 50 volunteers that included students from Malawi's College of Medicine, medical staff to provide HIV testing and care, and interviewers from the local population. They called large and long public meetings in each village to familiarize the islanders with the disease, to demonstrate the team's procedures and to generate collaboration among the inhabitants. "People were very, very welcoming," Helleringer reports. "They took care of things for us. They found us accommodations. They helped us find food. And I think it had to do with the fact that, you know, the study was bringing some kind of life to the island."

One of the reasons Likoma was chosen for the study, besides its diffuse HIV rate, is its position as a "dead angle." Unlike bustling capital cities or metropolitan areas, there are not a lot of people coming to the island or leaving it. This stability and the manageable size of the population would prove crucial in mapping individuals' relationships.

In 2005, before beginning work on the survey, Helleringer and his team took a census of the island, recording the names, nicknames and ages of everyone

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Jemima A. Frimpong

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in a particular household as well as the GPS coordinates of the houses and various landmarks: the primary school, the village center, the local well. This data would become the basis for identifying sexual partnerships and exactly where those partners were located.

Initially that summer, the team interviewed half the adult population, asking intimate questions. One of the reasons data on sexual networks remains scarce is the belief that people will not answer questions like, Who are you currently sleeping with? But Helleringer found that the islanders were willing to give their answers once it was explained why the information was important and once they were assured of confidentiality.

There were some tense moments though. To enhance individual privacy, the team used speech-enabled laptops rather than human interviewers to ask the questions. But a number of islanders became alarmed. "How can this machine be asking me questions?" they worried. "How does this machine know where I live?" In a few cases, the "speaking computers" – and the staff members – were accused of witchcraft. Emergency community meetings were called to explain the process and demonstrate the use of recordings.

While the data gathered from the interviews will be studied for some time, one early result is both surprising and counterintuitive. Past research has focused on individuals who have many partners, "super spreaders," who single-handedly spread the virus. Helleringer's data reveal a large, interconnected web of people, 65 percent of Likoma's population, who reported having an average of only two or three partners over three years. "We did not expect to find that having a small number of partners would actually connect such a large part of the population in one big network," he says. This finding

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Helleringer returned with his team to Likoma in the summer of 2007 and interviewed the entire population between the ages of 15 and 59, around 2,500 people. He hopes to use those data to tease out changes that have occurred in relationships on the island, to track the effects of antiretroviral drugs, to ascertain whether HIV has become more or less prevalent, and, if it has become more widespread, to map out behavior patterns that could explain why.

The initial funding for Helleringer's project came from a pilot grant from Penn's Population Studies Center. "I doubt that granting institutions like the NIH would have taken the risk of funding this research," he speculates. "Indeed, it really wasn't clear early on that inhabitants of Likoma would be willing to disclose their sexual partnerships or tell a computer whom they had slept with in the past three years. But our reviewers at Penn deemed it was a risk worth taking." Following publication of the study's initial results, Helleringer has secured additional funding from the NIH and now hopes to extend the study to a five-year project.

Beyond the value of what the research will ultimately reveal, the Likoma study breaks new ground by showing what a real-life sexual network looks like where HIV has spread extensively. It is not a computer simulation. It proves that personal data can be collected, which should encourage other studies in other contexts.

Helleringer defended his dissertation on the initial Likoma study last year and is a post-doctoral researcher in the sociology department. He steamed across Lake Malawi in April and continues his work on the island.

James Mkandawire